Instruction 51-1042
4-6-06

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Because every industry has a leader

Installation Instructions: S&S® Replacement Cylinder Heads for 1984-1999 Harley-Davidson® Evolution® Engines and 1986-2003 Sportster® Motorcycles

S&S® Super Stock® Cylinder Head Kit contains all parts needed for complete installation. Special S&S pistons shown should be used on conjunction with S&S heads for maximum performance. S&S cylinder head kits are available for 3½" and 3⅝" bore engines.

DISCLAIMER:

S&S parts are designed for high performance, off road, racing applications and are intended for the very experienced rider only. The installation of S&S parts may void or adversely effect your factory warranty. In addition such installation and use may violate certain federal, state, and local laws, rules and ordinances as well as other laws when used on motor vehicles used on public highways, especially in states where pollution laws may apply. Always check federal, state, and local laws before modifying your motorcycle. It is the sole and exclusive responsibility of the user to determine the suitability of the product for his or her use, and the user shall assume all legal, personal injury risk and liability and all other obligations, duties, and risks associated therewith.

The words Harley®, Harley-Davidson®, H-D®, Sportster®, Evolution®, and all H-D part numbers and model designations are used in reference only. S&S Cycle is not associated with Harley-Davidson, Inc.

SAFE INSTALLATION AND OPERATION RULES:

Before installing your new S&S part it is your responsibility to read and follow the installation and maintenance procedures in these instructions and follow the basic rules below for your personal safety.

● Gasoline is extremely flammable and explosive under certain conditions and toxic when inhaled. Do not smoke. Perform installation in a well ventilated area away from open flames or sparks.

● If motorcycle has been running, wait until engine and exhaust pipes have cooled down to avoid getting burned before performing any installation steps.

● Before performing any installation steps disconnect battery to eliminate potential sparks and inadvertent engagement of starter while working on electrical components.

● Read instructions thoroughly and carefully so all procedures are completely understood before performing any installation steps. Contact S&S with any questions you may have if any steps are unclear or any abnormalities occur during installation or operation of motorcycle with a S&S part on it.

● Consult an appropriate service manual for your motorcycle for correct disassembly and reassembly procedures for any parts that need to be removed to facilitate installation.

● Use good judgement when performing installation and operating motorcycle. Good judgement begins with a clear head. Don't let alcohol, drugs or fatigue impair your judgement. Start installation when you are fresh.

● Be sure all federal, state and local laws are obeyed with the installation.

● For optimum performance and safety and to minimize potential damage to carb or other components, use all mounting hardware that is provided and follow all installation instructions.

● Motorcycle exhaust fumes are toxic and poisonous and must not be inhaled. Run motorcycle in a well ventilated area where fumes can dissipate.

IMPORTANT NOTICE:

Statements in this instruction sheet preceded by the following words are of special significance.

⚠ WARNING

Means there is the possibility of injury to yourself or others.

⚠ CAUTION

Means there is the possibility of damage to the part or motorcycle.

NOTE

Other information of particular importance has been placed in italic type.

S&S recommends you take special notice of these items.

WARRANTY:

All S&S parts are guaranteed to the original purchaser to be free of manufacturing defects in materials and workmanship for a period of twelve (12) months from the date of purchase. Merchandise that fails to conform to these conditions will be repaired or replaced at S&S's option if the parts are returned to us by the purchaser within the 12 month warranty period or within 10 days thereafter.

In the event warranty service is required, the original purchaser must call or write S&S immediately with the problem. Some problems can be rectified by a telephone call and need no further course of action.

A part that is suspect of being defective must not be replaced by a Dealer without prior authorization from S&S. If it is deemed necessary for S&S to make an evaluation to determine whether the part was defective, a return authorization number must be obtained from S&S. The parts must be packaged properly so as to not cause further damage and be returned prepaid to S&S with a copy of the original invoice of purchase and a detailed letter outlining the nature of the problem, how the part was used and the circumstances at the time of failure. If after an evaluation has been made by S&S and the part was found to be defective, repair, replacement or refund will be granted.

ADDITIONAL WARRANTY PROVISIONS:

(1) S&S shall have no obligation in the event an S&S part is modified by any other person or organization.

(2) S&S shall have no obligation if an S&S part becomes defective in whole or in part as a result of improper installation, improper maintenance, improper use, abnormal operation, or any other misuse or mistreatment of the S&S part.

(3) S&S shall not be liable for any consequential or incidental damages resulting from the failure of an S&S part, the breach of any warranties, the failure to deliver, delay in delivery, delivery in non-conforming condition, or for any other breach of contract or duty between S&S and a customer.

(4) S&S parts are designed exclusively for use in Harley-Davidson® and other American v-twin motorcycles. S&S shall have no warranty or liability obligation if an S&S part is used in any other application.

INTRODUCTION

S&S® Super Stock® cylinder heads are designed to fit all Harley-Davidson® Evolution® big twins and Sportster® models. These heads require no additional clearancing when replacing stock heads on engines installed in stock chassis. All the parts needed for installation are included. Stock parts not supplied such as rocker arms, rocker cover assemblies and some mounting hardware should be reused when reassembling the engine.

NOTE: *S&S cylinder heads are designed to work with all aftermarket roller rocker arm assemblies also.*

Special Features of the Major Kit Components:
The shapes of the S&S cylinder head combustion chamber and piston dome are identically matched to create a high quench, closed combustion chamber designed to improve mixture turbulence and flow. For optimum performance it is recommended that these parts be used together.

The intake and exhaust ports are a cast to shape design that yields approximately 25% more flow than stock heads.

The special intake manifold included for improved flow has larger runners, 1.780", to match the larger intake ports on the heads and a directional vane to help split the incoming mixture as it passes the valve guide.

The valve train components are designed to improve flow and work with any present day fuel. Clearances are set for any S&S camshaft with a lift of up to .630" without modification. If cams with lift of over .630" lift are to be used, head kits may be ordered with special high lift, racing spring kits, allowing the use of cams of up to .660" lift.

KIT CONTENTS:

- One set of S&S Super Stock cylinder head assemblies complete with valves, valve springs, valve guide seals and keepers installed.
- One set of S&S pistons complete with rings, wristpins and wristpin keepers.
- One S&S intake manifold with O-ring seals and mounting flanges.
- Rocker cover gaskets, cylinder head and base gaskets, exhaust pipe gaskets and pushrod tube and alignment dowel O-rings.
- Hardware which includes cylinder head alignment dowels, exhaust port stud lockwashers and nuts, cylinder head mounting bracket bolts and washers, and manifold mounting screws and washers.
- Installation instructions.

NOTE: *Other S&S products such as adjustable chrome moly pushrods, cam, Hydraulic Lifter Limited Travel kit, and Super carburetor which may enhance the operation of S&S Super Stock cylinder heads may be purchased separately. In some instances many of these parts are sold with S&S heads as part of a stroker or Sidewinder® big bore kit or one of our popular Hot Set Up Kit™.*

INSTALLATION STEPS

1. Remove Components and Inspect Parts
2. Check Piston Alignment in Cylinder Bore
3. Piston and Cylinder Fitting
4. Rebalance Flywheels (883 & 1100 Sportster® models only)
5. Install Pistons, Cylinders and Heads
6. Finish Assemble Top End, Install Carburetor and Replace Gas Tanks
7. Engine Break-In Procedure
8. Performance Notes

INSTALLATION INSTRUCTIONS

Installation of an S&S Super Stock cylinder head kit is easy and can be performed by any Harley-Davidson® repair shop equipped to do engine overhauls. No special tools other than those used in normal overhaul repair work are required.

Read instructions thoroughly before starting work. When they are completely understood proceed with installation.

1. Remove Components and Inspect Parts
Follow procedures outlined in appropriate Harley-Davidson® service manual to prepare motorcycle for top end service.

NOTE: *Disconnect battery and drain all gasoline from gas tanks before doing any work.*

⚠ WARNING

Gasoline is extremely flammable and explosive under certain conditions and toxic when breathed. Do not smoke. Perform installation in a well ventilated area away from open flames or sparks.

A. Remove gas tanks and all other parts required to perform top end service.

B. Remove carburetor, rocker covers, pushrods and pushrod tube assemblies, cylinder heads and cylinders. Also remove piston rings from piston. Do not remove pistons.

NOTE: *Be careful not to introduce any dirt or other foreign material into crankcase during disassembly of engine.*

⚠ CAUTION

Metal filings, dirt and any other foreign contamination in engine may cause premature wear and/or irreversible damage to bearings and other internal engine components.

C. Thoroughly clean and inspect all parts that are to be reused. Any parts that show signs of wear or damage should be replaced.

2. Check Piston Alignment in Cylinder Bore

The purpose of this procedure is to check for and correct possible piston misalignment in the cylinder bore. During normal manufacturing, engine components such as crankcases, cylinders, and connecting rods can be machined to dimensions within factory specifications but on the extreme ends of the tolerance range. Sometimes these components when combined together form an assembly that is borderline or actually "out of print". The worst result is that the pistons can run cocked in the cylinder bores causing the connecting rods to thrust to the sides exerting unnecessary stress on the pistons, rings, rod bearings and other related parts. This procedure is not the same as blue printing, but it provides almost the same result. We feel that not enough emphasis is given to checking the piston alignment in the cylinder bore.

NOTE: *All engines should be checked upon disassembly. This applies to any engine receiving new pistons which includes those being completely overhauled.*

⚠ CAUTION

Pistons which do not run true in cylinder bores may cause excessive connecting rod side thrusting. This may lead to premature ring, piston, connecting rod and rod bearing wear and eventual failure of these parts.

Visual Procedure

A. Reinstall cylinders on old pistons without rings. Hold cylinders securely in place.

B. Move piston tight toward camside of engine.

C. Turn engine over in normal direction of travel 2 or 3 revolutions and observe piston during process.

D. Move piston toward driveside of engine and repeat Step C. If misalignment exists, piston will appear closer to cylinder wall at one point around circumference. Condition can be corrected by bending rod in opposite direction. **Figure 1** shows an exaggerated side view.

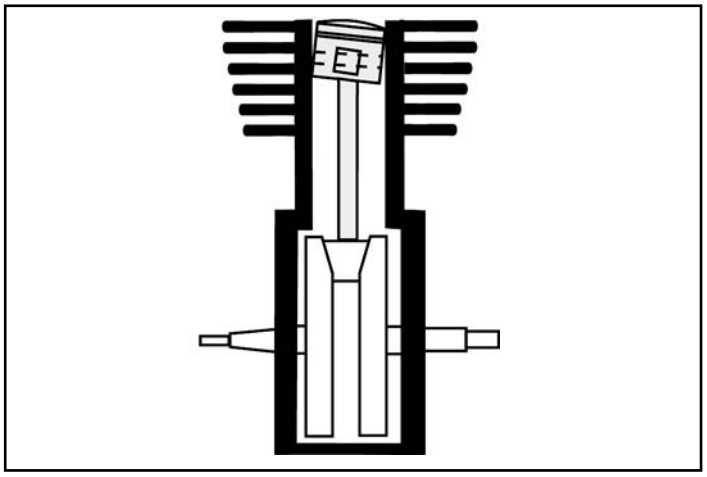


Figure 1

E. Repeat Steps B to D for other cylinder.

F. Remove pistons and cylinders. Observe pistons for wear spots on sides above top compression ring. If either side near wristpin is worn clean while side opposite is carboned up, then piston was not running straight and true in cylinder bore. Piston will also generally show diagonal wear pattern on thrust faces of skirts and possibly signs of connecting rod to wristpin boss contact inside piston.

Checking Pin Procedure

NOTE: *S&S® rod checking pin, part 53-0002, is designed to help perform this procedure. It may also be necessary to fabricate a rod bending tool as illustrated in* ***Figure 2.***

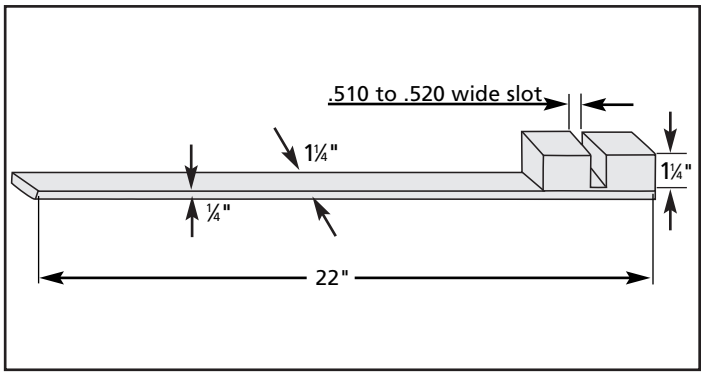


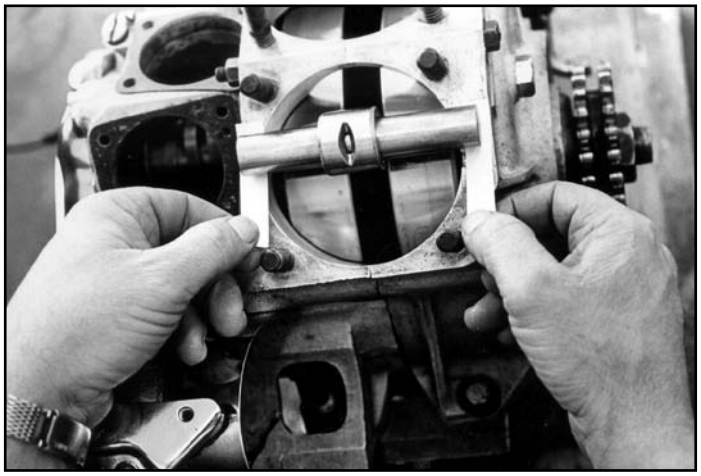
Figure 2

A. Insert checking pin into wristpin hole.

B. Place strips of paper between checking pin and crankcase cylinder gasket surface and apply slight downward pressure to wristpin end of rod by rotating flywheels.

C. Pull papers out slowly. Drag on papers should be equal.

D. Rotate flywheels in opposite direction until checking pin contacts cylinder gasket surface again. Repeat procedure to rod again. If drag on papers is equal, no bending is required. If one paper is loose, use rod bending tool to tweak rod in direction of loose paper and recheck. **See Picture 1.**



Picture 1

NOTE: *Do not bend rod by using tool in wristpin hole as this method may distort wristpin bushing. We also feel that using a piston in lieu of a checking pin may prove inaccurate due to variations in lengths of piston skirts from one side of piston to the other.*

E. Repeat checking and bending procedure for the other rod.

3. Piston and Cylinder Fitting

NOTES:

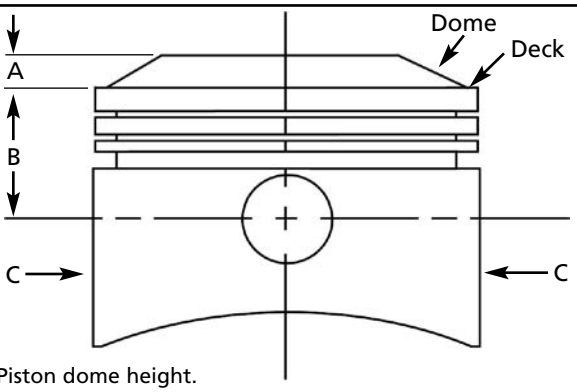
- *For maximum piston and ring life, fit pistons using appropriate close fit dimensions. Close fit requires strict adherence to new engine break-in procedures.*
- *For immediate drag strip use, fit pistons using appropriate loose fit dimensions. Attempt to break in rings and pistons with 50 easy miles if possible. Piston and ring life will be reduced when using loose fit dimensions.*

⚠ CAUTION

Failure to follow instructions and perform required clearancing, installation and/or break-in procedures correctly may result in damage to pistons and/or other engine components. S&S® voids its guarantee if pistons are not installed and/or broken in properly.

A. Measure piston across thrust face 90° to wristpin hole. Make a series of measurements starting directly below oil ring groove and ending at extreme bottom of skirt. Use widest measurement to represent size of piston. **See Figure 3.**

NOTE: *All 3½" and 3⅝" bore pistons for S&S Super Stock® cylinder heads have barrel shaped skirts. As a result, largest diameter is located ¼" to ½" above extreme bottom of skirt.* ***See Figure 3.***



A. Piston dome height.
B. Piston deck height.
C. Measure piston diameter on thrust face 90° from wristpin. Largest diamete will be ¼" to ½" from bottom piston skirt.

Figure 3

B. Determine size of cylinder. Refer to S&S piston fitting instructions 51-1028 for the clearance specifications.

C. Bore and hone cylinder to size required for piston plus proper desired running clearance. Use torque plates torqued to 50 ft. lb. to simulate stresses in an assembled engine.

NOTE: *S&S recommends using a 220 grit stone during final honing process. Using finer than 220 grit stones will result in smoother cylinder wall finishes which do not provide sufficient abrasion between cylinder wall, piston and rings nor sufficient oil retention for proper lubrication required for break-in.*

⚠ CAUTION

Insufficient cylinder wall lubrication during break-in process may result in piston scuffing and damage to pistons, rings and/or cylinders.

D. Thoroughly clean cylinders, pistons and all parts required to reassemble engine. Use high grade lacquer thinner on gasket surfaces.

⚠ WARNING

- **Some solvents, degreasers and other chemicals are harmful to skin, eyes and other body parts. Many items are flammable and present a fire hazard. Read manufacturer's instruction label for proper use. Use in well ventilated area and wear protective clothing when using them to avoid personal injury.**
- **Compressed air and particles dislodged by compressed air are harmful to eyes and body. Wear protective goggles when using compressed air and always direct air stream away from body parts such as hands and eyes. Never direct compressed air toward other people.**

4. Rebalance Flywheels (883 & 1100 Harley-Davidson® Sportster® models only)

This step applies to all Super Stock cylinder head installations on Sportster® 883 and 1100 engines.

NOTE: *S&S Super Stock 3½" and 3⅝" bore matching pistons are designed to replace stock 1200cc and 1340cc pistons and S&S 92-2420 and 92-1900 series pistons without requiring flywheel rebalancing. This also means that engines presently equipped with 3½" bore can be converted to 3⅝" bore without rebalancing. Rebalancing is required only when converting 883cc and 1100cc stock bore Sportster® engines to 3½" or 3⅝" bore.*

⚠ CAUTION

When converting 883cc and 1100cc stock bore Sportster® engines to 3½" or 3⅝" bore, failure to rebalance engine will cause engine vibrations possibly resulting in damage to engine components.

A. Follow Harley-Davidson® factory procedures outlined in Harley-Davidson® service manual for removing and disassembling engine.

B. Rebalance flywheels.

NOTE: *If engine is expected to be used under extreme conditions, it is recommended that the connecting rods in engines prior to 1989 be changed to Harley-Davidson® part #24275-86A or S&S 34-7800 as either of these assemblies is stronger than early stock Harley-Davidson® connecting rods.*

⚠ CAUTION

Under extreme conditions that exist in racing, early stock connecting rods may fail causing damage to the engine.

⚠ WARNING

Under extreme conditions as in a racing application, early stock connecting rods may fail causing the engine to inadvertently seize possibly causing loss of control of the motorcycle.

C. Reassemble bottom end using Harley-Davidson® factory service procedures.

5. Install Pistons, Cylinders and Heads

A. Install cylinder base gaskets provided dry. Be sure gaskets match cylinder base line-up dowels and oil return passageways.

B. Install pistons on rods without rings and wristpin clips.

C. Slip cylinders in place over cylinder studs and pistons.

D. While applying pressure to cylinders, rotate flywheels in normal direction of travel for at least one complete revolution. Note if there is any resistance or contact between pistons at any point in rotation. If contact or resistance occurs, it must be diagnosed and corrected.

NOTE: *Since it is nearly impossible to anticipate every possible engine combination, it is the engine builder's responsibility to check for proper running clearances. S&S® considers checking and establishing all running clearances as standard engine building practice that must be performed during engine assembly. Engine failure due to improper clearances between moving parts is not covered under warranty.*

⚠ CAUTION

Contact between moving engine components may cause damage or destruction of the parts involved and produce abrasive particles which may cause damage or premature wear to other engine components.

E. While applying pressure to cylinders, rotate flywheels so front piston is positioned at top dead center. Note where piston deck **(See Figure 3 on page 5)** is positioned in relationship to head gasket surface. Most stock Harley-Davidson® big twin and S&S engines should have the top surface of the piston flush with or slightly below the top surface of the cylinder (with a .020" thick cylinder base gasket in place). After installing heads, there should be .045" piston-to-head clearance at TDC when using S&S heads, or .0625" clearance when using stock heads. The clearance is provided by the thickness of the head gasket used.

NOTES:

- *All S&S cylinder head kits are supplied with .045" thick head gaskets, because this clearance promotes better combustion chamber turbulence and flame travel. If the .045" head gaskets are used with other cylinder heads, piston to head and valve to piston interference may occur.*
- *S&S kits for use with cylinder heads other than S&S are supplied with .0625" thick gaskets. If the .0625" gaskets are used with S&S heads, performance may suffer.*

⚠ CAUTION

Insufficient clearance between piston domes and cylinder heads or piston domes and valves will cause damage to pistons, heads and/or valves. It is the engine builders responsibility to check for adequate clearance regardless of head and gasket combination.

F. Repeat procedure to check rear piston to cylinder gasket surface relationship.

G. Install piston rings and wristpin clips per S&S piston instruction sheet 51-1028.

H. Coat piston skirts with engine oil and install cylinders.

I. Spin each head bolt down on its respective stud to be sure threads are clean and free of contamination.

J. Install head alignment dowels in cylinder. (Do not re-use any dowels that are damaged, or have flanges or an O-ring groove machined into them.)

K. Place head gaskets onto cylinder and over head alignment dowels.

If the gasket fits close to the dowel pin and there is not room for an O-ring, do not install an O-ring.

If there is room for an O-ring, install one O-ring over each dowel per the note below.

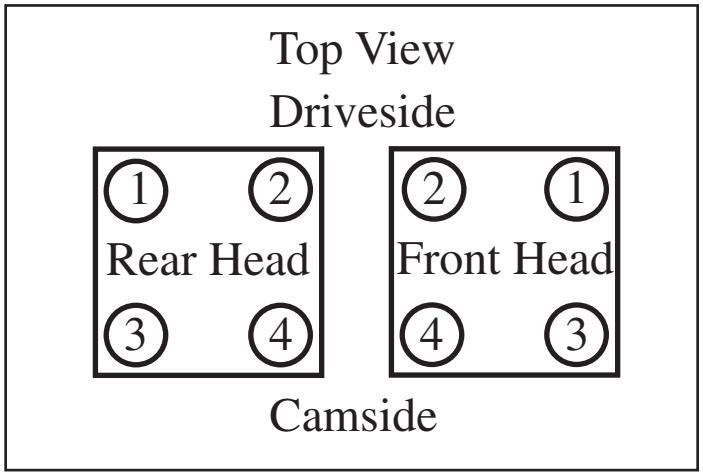
NOTE: *There are two sizes of alignment dowel O-ring available: .070" diameter O-rings are to be used with .045" thick gaskets. .0825" diameter O-rings are to be used with .0625" thick gaskets.*

⚠ CAUTION

Using thin O-rings with thick gaskets or thick O-rings with thin gaskets may cause oil leaks or possible ruptured head gaskets around line-up dowels due to incorrect O-ring compression.

L. Ensure that the head gaskets and O-rings (if used) are correct for the application, then remove them and carefully clean head and cylinder gasket surfaces with lacquer thinner or equivalent. Gaskets are to be installed clean and dry. Do not use gasket sealing compounds on cylinder head gaskets.

M. Bolt heads on cylinders. Clean threads of head bolts and cylinder studs. Place one or two drops of oil on threads of each head bolt just prior to final assembly to reduce friction and insure accurate torque readings. Tighten bolts in stages using crossing pattern. If using S&S® or stock crankcases, follow the the torque and sequence chart. **See Figure 4.** If using other aftermarket crankcases, contact the manufacturer for recommended head bolt torque specifications.



	S&S® Crankcases	Stock Crankcases
Stage 1	8 ft-lbs.	7-9 ft-lb
Stage 2	18 ft-lbs.	12-14 ft-lbs.
Stage 3	Turn Additional 90°	Turn additional 90°

Figure 4

NOTE: *Light coating of oil on head bolt threads minimizes friction so torque values are not distorted. It cannot be emphasized enough how important it is to do these steps carefully. Maintaining a good head gasket seal depends on it.*

⚠ CAUTION

Improper torquing sequence and head bolt torque values may cause head gasket failure. Excessive torque values may cause studs to pull out of crankcase.

6. Finish Assemble Top End, Install Carburetor and Replace Gas Tanks

Follow Harley-Davidson® factory procedures outlined in Harley-Davidson® service manual to assemble rocker cover components and other parts that were removed for top end service.

A. Install rocker arm bases per Harley-Davidson® specs.

B. Assemble rocker arms, pushrods and pushrod tube assemblies and adjust pushrods.

C. Install rocker covers using gaskets provided.

D. Install intake manifold, mounting flanges and O-ring seals provided. Be sure O-rings and flanges are assembled in correct sequence. **See Figure 5.** Use flange marked "F" on front head and flange marked "R" on rear. Slotted end of mounting flange goes toward lower manifold mounting hole. Flat washer provided is used on slotted end of flange. Do not tighten mounting flange screws.

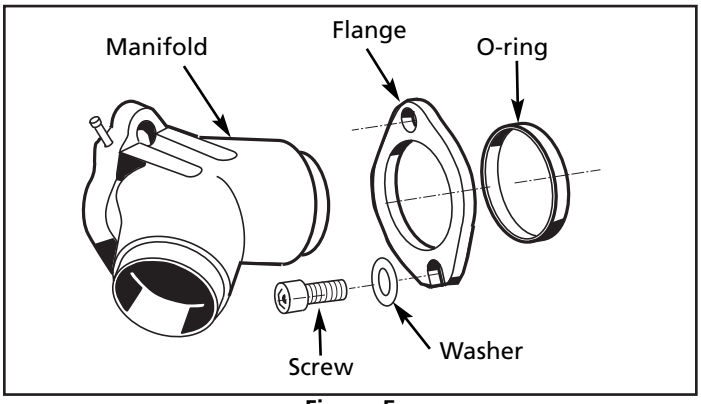
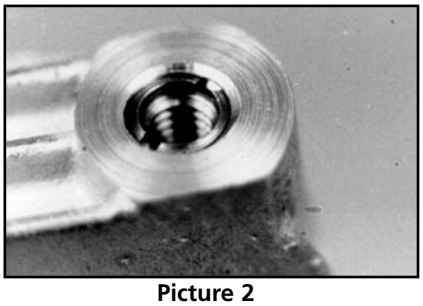


Figure 5

NOTE: *Special S&S manifold must be used with S&S heads because intake port diameters of S&S heads are larger than stock. Special S&S manifold requires O-ring seals which also have larger than stock diameter to fit O.D. of manifold runners. These O-rings, S&S part 16-0235, are included and cannot be used in stock applications.*

E. Bolt carburetor and air cleaner assembly in place using carburetor instructions supplied from manufacturer.

NOTE: *S&S cylinder heads are machined for use on all big twin engines. Heads are drilled and tapped to accept ½"-13 air cleaner mounting bolts used on 1992 big twin heads or ½"-13 threaded cylinder head vent fittings used on 1991 and later Sportster® models and 1993-up big twins. For installation on 1984 to '91 big twins and 1986 to '90 Sportster® models, screw thread reducing inserts, part 90-4026, in carburetor backplate mounting holes in cylinder heads. Surface of insert should be just slightly below machined surface of head so backplate rests against head and not insert.* ***See Picture 2.*** *Insert (threadsert) will reduce hole to ⅝"-18 threads to accept stock 1984 to '91 air cleaner mounting bolts. Threadserts may be supplied with or without a thread locking compound already applied to threads. Loctite or equivalent thread locking compound should be applied sparingly to threads of those not pre-coated during installation. Threadserts with preapplied thread locking compound should be installed in desired position and left in place.* ***IMPORTANT*** *- Screwing threadsert in hole activates compound and locks it in position making it difficult to change after compound has set up.*



Picture 2

⚠ CAUTION

Installation of threadsert where it protrudes above air cleaner backplate mounting boss surface may damage air cleaner backplate.

F. Reassemble gas tanks and all other parts that were dissembled during preparation for top end service. Be sure there are no gasoline leaks and that throttle opens and closes smoothly and snaps shut when released.

NOTE: *Throttle must not bind and must snap shut to fully closed position when released.*

⚠ WARNING

If throttle does not return to fully closed position when released, it may inadvertently stick open possibly causing loss of control of motorcycle and personal injury to you or others.

NOTE: *Fuel needle and seat assembly must completely shut off fuel supply entering bowl. Fuel line connections must not leak.*

⚠ CAUTION

Unwarranted gasoline leaking by fuel inlet needle may flood engine causing damage to components.

⚠ WARNING

Unwarranted gasoline leaks at fuel line connections and/or past inlet needle may flood engine and overflow on surrounding area creating fire hazard.

7. Engine Break-In Procedure

A. Upon initial start-up, quickly check to make sure oil pressure is normal and no leaks exist. With minimal load on engine, ride motorcycle at low speeds until cylinder head temperature reaches about 250°. Do not crack throttle or subject engine to any heavy load during this period as big twin head gaskets are susceptible to failure until heat build-up is completed. Heat build-up is necessary to cause heads and cylinders to expand and seal. Improper initial engine start-up and break-in procedure may cause head gasket failure.

⚠ CAUTION

Do not allow engine temperature to become excessive as permanent engine damage may result.

B. First 50 miles are most critical for new rings and piston break-in. Most engine damage will initially occur during this period. Keep heat down by not exceeding 2500 rpm. Vary speed. Do not lug engine.

C. Next 500 miles should be spent running engine no faster than 3500 rpm or about 50-55 mph. Do not lug engine and continue to vary speed.

⚠ CAUTION

Lugging or running engine prematurely at high rpms may result in damage to pistons and/or other engine components. S&S® voids its guarantee if engine is not broken in properly.

D. For balance of first 1000 miles, speed can be run up to 60 to 70. Continue to run engine at all different speeds including lower 40-45 mph ranges.

E. 1000 to 2000 miles—basically same procedures as before. You can be a little more liberal with rpm range. Avoid overheating engine and putting any hard strain on engine (drag racing, trailer towing, sidecar operation).

G. 2000 miles and up—have fun!

8. Performance Notes

Ignition Systems

- Stock electronic ignition systems are satisfactory, but usually will not allow modified engines to realize their full potential. The S&S Intelligent Spark Ignition system (IST) provides optimum ignition timing for any engine and works in all but turbocharged and supercharged applications. It learns about the engine it is installed on, automatically senses the beginnings of spark knock, and sets the advance curve and total advance for maximum performance under all conditions. If not using an S&S ignition, a point type ignition system or an aftermarket high performance electronic unit is recommended. This allows flexibility in engine timing not possible with stock ignition systems.
- Spark plugs - Use spark plugs that are compatible with the ignition system. If you are in doubt, most manufacturers can recommend which plugs they prefer you use with their system. Dual plug installations in S&S Super Stock® heads are not necessary.
- Flywheels - S&S flywheels have timing marks that when located in the center of the timing hole position the pistons in the same location before top center as stock Harley-Davidson® flywheels. Placing the mark to the right side of the hole or just entering the hole advances timing almost 5°. Vice versa, if the mark is just leaving the hole, timing is retarded almost 5°.
- Timing - Tests conducted using S&S Super Stock® heads on big twins and Harley- Davidson® Sportster® models showed that best performance was achieved with the ignition timing set at; 4" bore engines 28°-30° total advance, 3½" and 3⅝" bore 30°-32° total advance.

  Once the engine is timed and operating, monitor it for excessive heat. Too much heat can mean that timing is set incorrectly and should be adjusted to prevent engine damage.

⚠ CAUTION

Improper ignition timing may cause excessive engine heat which may damage pistons and/or other engine components.

Carburetion

- All S&S® test engines are run using S&S carburetors. S&S Super E and G carburetors are recommended for most applications with the Super G being used more often on larger displacement, freer breathing engines with higher compression ratios. Typically, engines equipped with S&S heads require the same or slightly leaner jetting than those engines fitted with stock heads. Consult the carburetor jetting instructions for specific jetting recommendations.

- If another type carburetor is used, it must be made to run rich enough to operate properly and to prevent engine damage. If you have a problem with another carburetor, S&S cannot help you and recommends you call the carb manufacturer with any questions you may have.

- If the motorcycle is used exclusively on a drag strip where engine temperatures vary, slightly richer jets may be necessary for best performance. Larger jets/richer mixtures will enable one to run a colder engine which is sometimes desirable. This is best determined by experimentation.

- Carburetor jetting and spark plug color - While spark plug color may be used to help determine carburetor jetting, S&S recommends that our instructions be used as primary jetting guide and that plug color indications be used only as secondary aid. We have found that different brands of gasoline, gasoline additives, engine heat (due to ignition timing), and brands of plugs and heat range used distort plug color drastically making plug reading difficult for the average tuner. Also, new plugs usually require a road test of 10 miles or more to properly develop the color which means that quarter mile tests may not be long enough and hence, not always a good indication of carb jetting. It is best to use proven spark plug combinations and to consult the spark plug manufacturer if you have questions.

- Cams and exhaust systems can make some engines difficult to carburate. We have found that certain cams and exhaust systems will cause poor performance at a specific rpm, and attempts to correct jetting for that specific level usually destroys carburetion over the balance of the range. A combination of cam overlap, reversion, and back pressure, or even lack of back pressure can cause mixture dilution at certain engine rpms. This dilution will cause engine roughness or misfiring when engine is held in this range.

Exhaust Systems

- Drag pipes - While drag pipes can be used with good results to establish performance guidelines on the 1984 and earlier engines, they are generally not recommended for 1984-1999 big twin engines in street applications. These big twin engines are easier to carburate with muffled systems.

- Muffler systems: Most stock and many aftermarket exhaust systems are too restrictive and made exclusively for looks with little consideration given to performance. A very good, economical street system for big twin engines consists of the stock header pipes with the crossover tube and a set of low restriction mufflers. S&S offers a series of mufflers that can be used with stock header pipes that work very well. This combination will typically produce more horsepower and torque than drag pipes in the midrange. Since the midrange is where the vast majority of normal driving occurs, it makes this system ideal for the street.

Gearing

- Gearing depends on the total weight of the machine and rider/s, the size of the engine, cam(s), exhaust system and type of riding to be done. Most high performance engines, and particularly those with larger displacements, are capable of pulling more gear. We suggest you break the engine in with stock gearing to minimize the load on the engine. After the engine is broken in you will have a better feel of its potential and can change gearing accordingly.

- For those who wish to determine their final drive gear ratio the formula is as follows:

$$\text{Engine Revolutions Per One Revolution of Rear Wheel} = \frac{\text{(Clutch Sprocket*) x (Rear Wheel Sprocket*)}}{\text{(Motor Sprocket*) x (Transmission Sprocket*)}}$$

*Number of teeth on each sprocket

Compression

- Generally speaking, big twin engines with the proper camshaft selection can operate using higher compression ratios with fewer problems than their earlier counterparts. Keep in mind, though, that while engines with higher compression ratios make more horsepower and perform better, they also tend to lose that performance edge faster, require more maintenance and start harder. As a rule, we prefer to limit the compression ratio to no greater than 11 to 1 for engine combinations used in normal street operation. A word of caution is in order. Before building an engine you may regret later on, carefully consider your riding needs, riding style and overall performance objectives.

Abbreviation "NS" means part is not shown in diagram.

1. Cylinder head - 1984-99 big twin

2. Valve

Intake

2.000" diameter **90-2000**

2.000" + .085" diameter **90-2004**

Exhaust

1.605" diameter **90-2001**

1.605" +.085" diameter **90-2005**

3. Valve seat - All

Intake - 2.000" diameter **90-2002**

Exhaust - 1.605" diameter **90-2003**

4. Valve guide - intake or exhaust

All

Standard (Harley-Davidson® #18112-92) **90-2210**

+.001" (H-D® #18130-83C) **90-2211**

+.002" (H-D® #18133-83A) **90-2212**

+.003" (H-D® #18131-83C) **90-2213**

+.030" **90-2219**

5. Valve spring shim - 1984-up

.015" **90-2086**

.030" **90-2087**

6. Valve guide seal - intake or exhaust

(H-D® #18001-83A) *(5 Pack)* **90-2195**

7. Valve spring kit, 1984-up

.640" lift - steel top collars **90-2077**

.640" lift - titanium top collars **90-2078**

8. Keeper, valve spring, intake/exhaust

Two required per valve. **90-2094**

9. Head mount bolt - ⅜"-16 x 1¼"

(H-D® #4716) **50-0168**

10. Flat washer - ⅜"

(H-D® #6019) **50-7051**

11. Head bolt assembly -

Includes head bolt washer.

12. Head bolt washer

.100" *(10 Pack)* **50-7096**

.250" (H-D® #6016) *(10 Pack)* **50-7095**

13. Exhaust port stud

(H-D® #16715-83) *(5 Pack)* **50-1028**

14. Lock washer - 5/16" (H-D® #7041)

(10 Pack) **50-7077**

15. Nut, HH - 5/16"-24 (H-D® #7833)

(10 Pack) **50-5048**

16. Exhaust pipe gasket -

(H-D® #65324-83) *(10 Pack)* **93-1072**

17. Thread conversion insert

½"-13 to 5/16"-18 . . . . . **50-8151**

18. Intake manifold -

19. Screw, manifold mounting

SH - 5/16"-18 x 1"

(H-D® #3201WA) *(10 Pack)* **50-0145**

HH - 5/16"-18 x 1" (H-D® #3987,4017)

(10 Pack) **50-0155**

20. Washer, flat - 5/16" (H-D® #6016,6702)

(10 Pack) **50-7069**

21. Flange, manifold mounting

Front (H-D® #27009-86A) **16-0232**

Rear (H-D® #27010-86A) **16-0233**

22. O-ring, manifold **16-0243**

23. Head gasket,

3½" Bore

.045" thick (No O-rings required.)

(H-D® #16770-84C) *(10 Pack)* **93-1024**

.0625" thick

(Includes gasket & dowel O-rings.)

(H-D® #16770-84B) *(10 Pack)* **93-1051**

3⅝" Bore

.045" thick (No O-rings required.)

(10 Pack) **93-1052**

.062" thick (No O-rings required.)

(10 Pack) **93-1053**

4" Bore

.045" thick *(10 Pack)* **93-1071**

24. O-ring, head gasket oil return -

.062" diameter

(For use on O-ring style dowel 93-1000.)

(H-D® #11105) *(10 Pack)* **50-8078**

.070" diameter (For .045" gasket w/stock style dowel 50-8023.)

(H-D® #26432-76X) *(10 Pack)* **50-8102**

.0825" diameter (For .0625" gasket w/stock style dowel 50-8023.)

(H-D® #26432-76A) *(10 Pack)* **50-8108**

25. Alignment dowel

(H-D® #16573-83) *(10 Pack)* **50-8109**

Dowel pin - ¼" dia. x ½"- 4" bore

(5 Pack) **50-8105**

26. Rocker cover gasket kits

1984-up big twin S&S billet rocker cover - rubber N/S **90-4049**

1984-up big twin S&S cast rocker cover - rubber N/S **90-4091**

1984-'91 big twin - cork (H-D® #17038-90). **90-4007**

1984-'91 big twin (H-D® #17038-90) **90-4046**

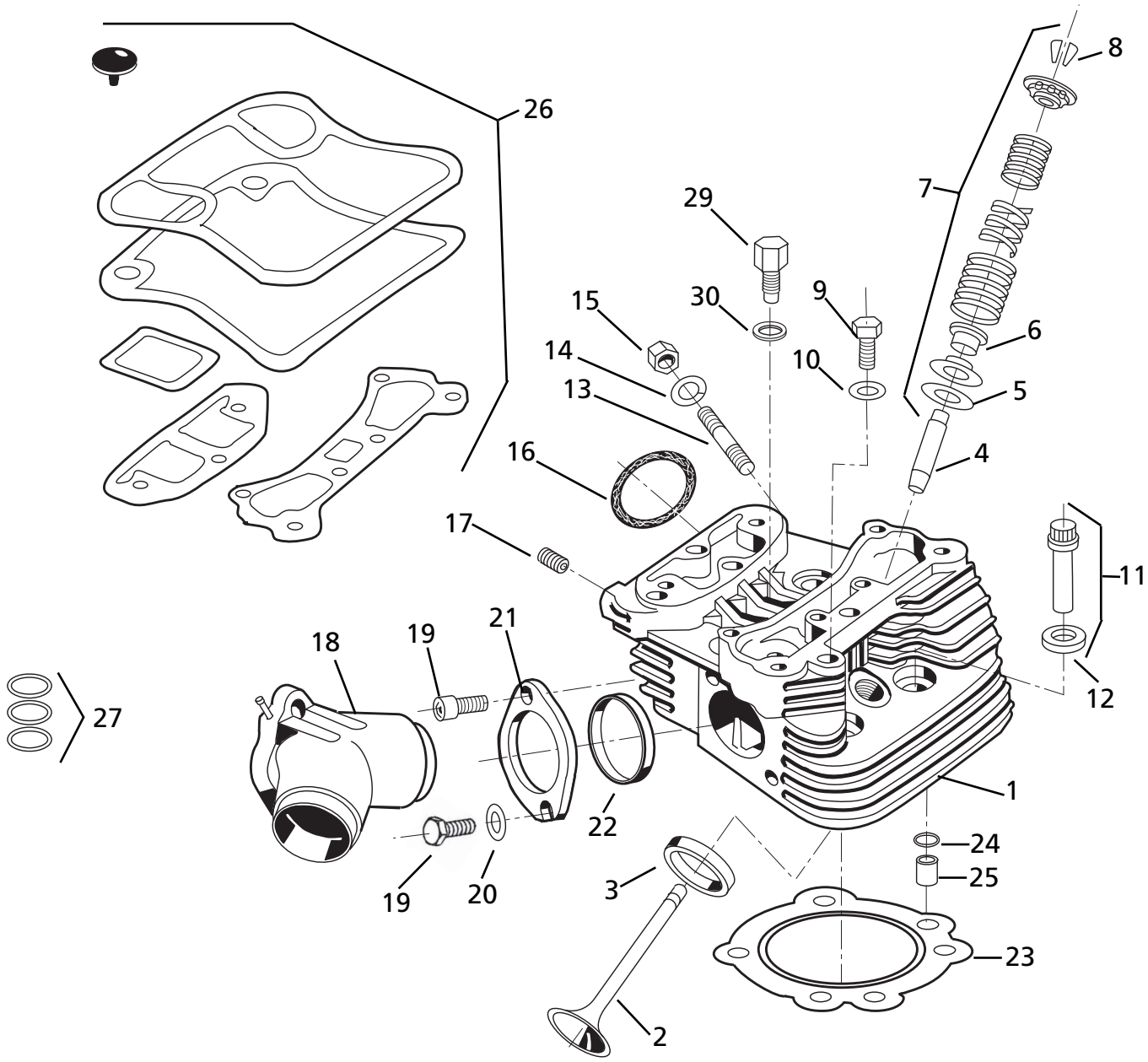
1992- '99 big twin - cork (H-D® #17042-92A) **90-4027**

1992- '99 big twin - rubber (H-D® #17042-92A) **90-4047**

1986-'90 Sportster® - cork. **90-4028**

1991- up Sportster® - cork (H-D® #17039-90A). **90-4029**

All reference to Harley-Davidson® part numbers is for identification purposes only. We in no way are implying that any of S&S® Cycle's products are original equipment parts or that they are equivalent to the Harley-Davidson® part number shown.



27. Pushrod cover O-ring kit
1984-'99 big twin, 1986-'90
Harley-Davidson® Sportster® **93-4022**
Includes 4 each:
Bottom (Harley-Davidson® #11145) **50-8037**
Middle (H-D® #11132) **50-8038**
Top (H-D® #11157, #11190) **50-8039**

28. Flat washer, bottom pushrod tube N/S
(H-D® #6737) *(10 Pack)* **50-7151**

29. Plug, HH - 14mm **90-4916**

30. Washer, compression - 14mm
.507" x .705" x .047" *(10 Pack)* **50-7102**

Because every industry has a leader